SELECTION OF OPTIMUM WAVELENGTHS FOR OZONE MAPPING FROM SATELLITES

P.K. Bhartia
SASC Technologies, Inc.

Wavelengths selected for measuring total ozone from the SBUV/TOMS instruments on Nimbus 7 are based on the Nimbus 4 BUV design. These wavelengths were selected in the late 1960s when the ozone absorption spectrum in the ultraviolet was not know in detail and the sources of uncertainty in measuring total ozone from space were not well understood.

A pair of wavelengths are required to measure total ozone in the ultraviolet. An appropriate set of wavelengths would be those that maximize accuracy and precision, while at the same time, allow retrievals as close to the terminator as possible. The measurement accuracy is improved by selecting the two wavelengths of the pair to be as close as possible. However, high measurement precision requires a large difference in the ozone cross-section at the two wavelengths of the pair. The ability to retrieve ozone near the terminator is improved by selecting wavelengths that have small optical depth in the atmosphere; such wavelengths, however, give inadequate measurement precision elsewhere. Faced with these conflicting requirements, a recommended strategy is to select three wavelengths: one at the peak of ozone absorption cross-section spectrum, another at a nearby minimum and a third wavelength that lies just outside the absorption spectrum. A pair formed using the first two wavelengths are then used under most observing conditions; another pair formed using the last two wavelengths are used near the terminator. There is no evidence that additional wavelengths (up to six in the case of TOMS) provide any benefit for measuring total ozone. Additional wavelengths, however, are necessary if other atmospheric species, such as SO_2, need to be measured.